Docket: T2211-906224

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of
BARRESI et al.
Serial No.: 09/355,987
Filed: August 24, 1999
For: Improved Foundry Alloy

Examiner: J. Combs-Morillo
Group Art Unit: 1742

DECLARATION

Assistant Commissioner of Patents
Washington, D.C. 20231

Sir:

I, Malcolm James Couper, declare that:

1. I am one of the co-inventors of the invention disclosed and claimed in United States Patent Application Serial Number 09/355,987, originally filed on August 24, 1999, titled "Improved Foundry Alloy".

2. I have earned the following degrees as a result of my formal education: Bachelor of Science (Hons), Monash University, 1978 and Ph.D. Eng. Sci., Monash University, Materials Engineering Department, 1982.

3. I have been involved in the research and commercialization of casting of aluminum-based alloys for 20 years, and am currently employed by Comalco Aluminium Limited, Australia as Manager, Metal Products Technology, Comalco Research & Technical Support..

4. In the course of assisting my patent attorneys and agents in pursuing patent protection for the Improved Foundry Alloy invention, I have carefully reviewed the portions (pages 133, 134, 164-166, 168) excerpted from Volume 2 of the ASM Handbook cited in rejecting the claims presented in the above-identified application.

5. As a person of at least ordinary skill in the art, I regard the discussion found at page 133 of the ASM Handbook, directed to "Structure Control", and the subpart directed to "Dendrite Arm Spacing", to be one of generalities. All the points made would not necessarily apply to all aluminum foundry products whose chemistries fall within the multitude of standard aluminum alloy grades that are disclosed in the same volume of the ASM Handbook. The handbook states (p133) that "Microstructural features such as the size and distribution of primary and intermetallic phases are considerably more complex to control by chemistry." I would add that they are even more complex to optimize. One example of the general nature of the handbook (p134) is: "grain refinement must introduce controlled, predictable and operative quantities of aluminides …". This is highly debatable if not wrong according to current publications. Another example is the section (p134) on modification which makes no mention of the adverse effect of Na in combination with Sr on modification (a long suspected and recently proven phenomena) and yet the handbook covers at length interactions of P.

6. Persons of ordinary skill in the art would not accept the statements set forth at page 133 as being true for any and all aluminum foundry alloys, regardless of composition. They would accept them as an initial guideline, but expect there to be possible exceptions or special cases.

7. As evidenced in the research results presented in the patent application (page 9), decreases in dendrite arm spacing alone did not consistently lead to an optimum (peak) improved product quality, as determined by the "Quality Index", or "Q.I." (page 4, FIG. 1), which is calculated based upon the ultimate tensile strength (UTS) percent elongation at fracture (E). These results do not correlate to the generalized discussion found in the cited excerpts of the ASM Handbook. As an example, citation has been made to FIG. 3 at page 134 of the ASM Handbook. That figure purports to show that both UTS and percent elongation at fracture consistently decrease with increased dendrite cell size. However, what it doesn't show is that the rate of decrease depends on Mg content. It turns out (unexpectedly) that because of this, **for a given dendrite cell size,** there is a peak in quality for a given Mg content. Furthermore (also unexpectedly) the optimum Mg content is different for different dendrite cell sizes. It is only in cases (practical applications) where it is strived to have the finest possible dendrite cell size that the benefit of optimizing the Mg content (by narrowing the range) is worthwhile.

8. The results presented in the patent application clearly evidence that the generalizations set forth in the ASM Handbook, and relied upon in rejecting the claims of the patent application, do not apply universally to all aluminum

foundry alloys, a point which is understood by persons of ordinary skill in the art.

9. Persons of ordinary skill in the art would thus not regard the discussion of structure control and dendrite arm spacing in the ASM Handbook as providing specific guidance as to the casting conditions and parameters that should be employed for the multitude of standard aluminum alloy grades listed in the ASM Handbook.

10. The aluminium alloy of the present invention is characterised by a quite specific composition and quite specific microstructure. The composition is narrowly defined in terms of a silicon concentration of 6.5-7.5 wt.% and a magnesium concentration of 0.40-0.45 wt.%. The microstructure is characterised by the sole or predominant iron-containing phase being β phase that forms as a transformation product of π phase in the originally cast alloy. As indicated in the patent application, the presence of β phase rather than π phase at the defined level of Mg improves the ductility of the alloy and results in higher levels of magnesium in solution that is then available for precipitation during ageing to improve strength of the alloy. The method of manufacturing the alloy of the present invention is characterised by solution heat treating cast alloy to at least partially transform π phase to β phase.

11. I believe that being able to produce an alloy that has β phase rather than π phase at this level of Mg and fine dendrite cell size is not generally known and

that this results in the optimum (peak) in quality index for this alloy type is a significant unexpected invention. .

12. In the office action the Examiner acknowledges that the ASM Handbook does not teach what phases are present in the alloys disclosed in the handbook. However, the Examiner argues that the disclosure in the patent application that "solution treatment at 540°C for two or more hours produced desired levels of transformation of π to β phase" is "substantially the same as the solution heat treatment steps" disclosed in the handbook.. The Examiner argues that, consequently, solution heat treatment of alloys as disclosed in the handbook would produce β phase.

13. The relevant disclosure in the handbook is Table 36. Contrary to the opinion of the Examiner, Table 36 does not provide a clear disclosure of the solution heat treatment conditions referred to the patent application. Whilst the table discloses the solution heat treatment temperature range referred to in the patent application, the disclosed solution heat treatment times of 12 hours (for sand castings) and 8 hours (for permanent mould castings) are significantly different to the "2 or more hours" referred to in the patent application. The clear implication in the reference to "2 or more hours" in the patent application is that solution heat treatment times as low as 2 hours can produce β phase. There is a considerable difference between solution heat treatment times of 2, 8 and 12 hours.

14. In summary, in my opinion it would not be obvious for a skilled person in the field of the invention to take the generalised disclosure of alloy compositions and solution heat treatment conditions in the ASM Handbook and produce the alloy of the invention.

15. All statements made herein of my own knowledge are true, all statements made on information and belief are believed to be true, and such statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 USC §1001, and may jeopardize the validity of this document, the patent application to which it pertains, and any patent issuing therefrom.

Date: 27 Sept 2002

M Couper

Malcolm Couper

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